BELLCOMM, INC.

SUBJECT: Status of Type-3N90 Transistor Problems Encountered in LM Instrumentation - Case 330

DATE: February 1, 1967

FROM: R. D. Raymond

MEMORANDUM FOR FILE

Sprague type-3N90 transistors from the first five lots used in amplifier and attenuator modules in the LM instrumentation signal-conditioning electronics assembly (SCEA), failed lot sample tests, apparently because of "purple plague." More recent lots (six and seven) have not exhibited failures, indicating that the current process is yielding good parts.

The disposition of SCEA modules containing transistors from earlier lots is the current question. Additional testing is being performed to provide data on which to base an evaluation of the use of already completed SCEA units for flight articles. ASPO suggestions to GAEC for additional testing of transistor samples from the failed lots included (1) temperature cycling, (2) monitored vibration with voltage applied, and (3) step-stress acceleration or bond pull tests. The joint NASA-GAEC CCB/CCP meeting on January 10 resulted in the following action items pertinent to these transistors and SCEA units:

1. Leave LM-1 unit as is;
2. Proceed with tests of transistors: 1000 hours at 100°C;
3. Forbid the use of suspect lots in LM-4 and subsequent;
4. Conduct a mission level vibration test for 1 minute per axis on the LM-2 SCEA unit;
5. Mount an effort to retrofit LM-2 and LM-3 units if at all possible;
6. Evaluate the criticality of measurements that these transistors support;
7. Place non-suspect units in critical channels on LM-2 and LM-3 units if total retrofit is not practical.

The type of lot sample test that was failed included a long duration soak at an elevated temperature of 200°C. The failure mode encountered is an open circuit or marginal-emitter bond due apparently to propagation of a reaction at the bond interface related to the high temperature. The result is a gold/aluminum interaction, referred to as "purple plague."

The 100°C temperature for retest of samples (and also a back-up test at 150°C) is still above temperatures to be encountered in LM applications (about 57°C operating and 71°C stored). These tests should be completed by March 10, 1967. It is anticipated that the current sample tests will provide sufficient data for confident resolution of the disposition of SCEA units in question.

2031-RDR-sam

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